Sea-ranching in the Bay of Brest (France): technical change and institutional adaptation of a scallop fishery[1]

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1. INTRODUCTION

Despite a long tradition of cohabitation between fishing and shellfish farming along French coasts, interactions between these two activities are rather limited[2] and consist mainly in the fishing by some shellfish farmers.[3] The two industries have completely distinct professional organisations, they seldom hire the same manpower and they concentrate the bulk of their respective activities on different species.[4]

The Bay of Brest, which is located at the extremity of the Brittany Peninsula (Figure 1), is at odds with this general picture. This traditional shellfish-harvesting area had its first experience of strong interaction between shellfish farming and fishing after the collapse of its scallop fishery in 1963. Deprived of their major source of incomes, local fishers attempted to diversify their activity by targeting other species of shellfish (including two types of smaller pectinids), but also by developing a new business in the field of shellfish farming. This innovative process was based on the indigenous flat oyster (*Ostrea edulis*), a species traditionally cultivated in various places along the French coast of the Atlantic and English Channel, but which so far was mainly harvested on natural beds in the Bay of Brest. A cooperative created by fishers at the beginning of the decade became the major tool of their diversification towards oyster farming. Its output of farmed oysters soared from 320 tonnes in 1962 to 1 600 tonnes in 1973. However, a parasitic disease, which appeared in the Bay in 1973, put an end to this experience (Anon., 1977).

A second experience of interaction between fishing and shellfish farming has developed in the Bay of Brest during the last two decades. In contrast to the former, it involves integrating both activities in a unified process, rather than (partly) substituting

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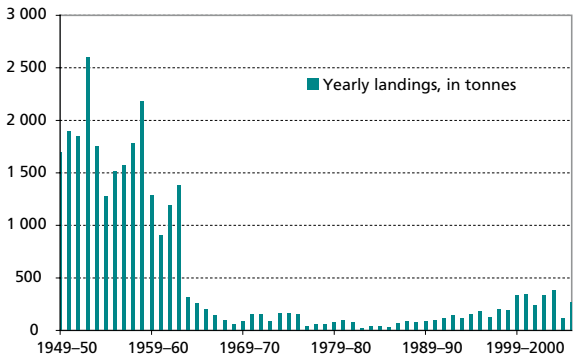
[2] Though the development of deepwater shellfish farming might develop space competition with inshore fishing.

[3] At the end of 2004, 11.7 percent of the total number of active fishing boats were registered in the "marine aquaculture/small-scale fishing" mixed category (Anon., 2005).

[4] In France, shellfish farmers grow mainly oysters and mussels and shellfish-capture fisheries mainly target scallops and clams.

FIGURE 1
The Bay of Brest

FIGURE 2
Bay of Brest scallop fishery: long-term evolution of landings



Source: local fisheries committee.

one for the other. The initial objective of the programme, which was launched in 1983, was to revive the activity of scallop dredging in the Bay by enhancing the natural spawning stock (Boucher and Dao, 1989). After a trial-and-error process resulting in a significant change in its initial philosophy, the programme took off during the second half of the 1990s (Fleury *et al.*, 2003; Boncoeur *et al.*, 2003).

The technical innovations behind this expansion required some institutional changes. A noticeable feature was that fishers themselves introduced these changes, in a legal and political context that could be seen as rather unfavourable. After a brief description of the fishery and of its restocking programme, we analyse the institutional mechanisms developed by local fishers to manage the new productive process. The last section of the paper discusses the limits of the system and its possible evolution.

2. THE FISHERY AND ITS RESTOCKING PROGRAMME

2.1 Shellfish dredging in the Bay of Brest

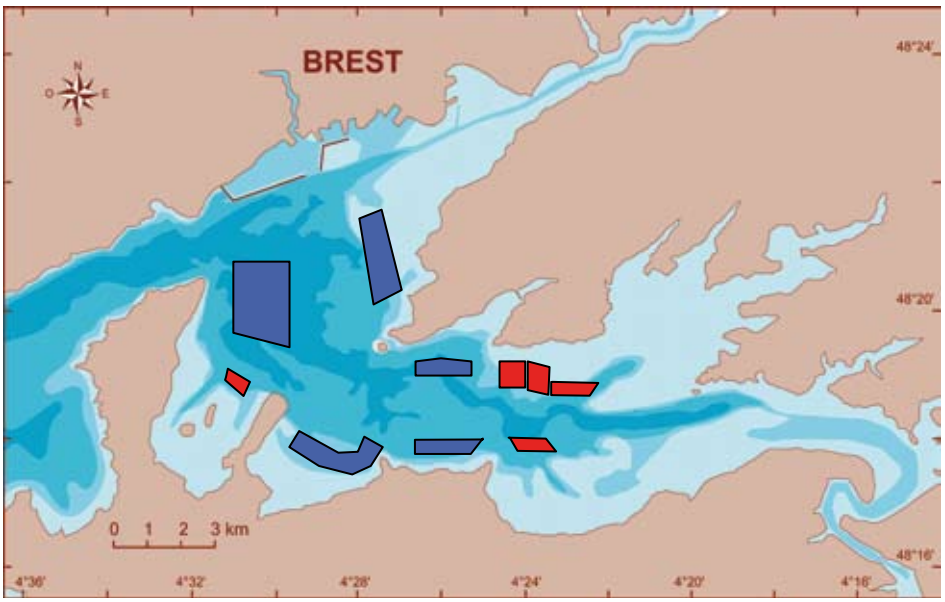
The Bay of Brest is a sheltered area of 180 km² and is surrounded by a densely populated zone[5] that is the base of various economic activities (naval base and military shipyard, commercial port, marina and intensive farming). Shellfish dredging is the only significant professional fishing activity in the Bay. It is a seasonal activity, with fishing campaigns usually taking place from October to March. When the season is over, most boats leave the Bay, to undertake various activities along the North-West coast of Finistère (Western part of Brittany) such as kelp harvesting or fishing with nets, pots and lines. The fishery is small-scale: in 2006, the fleet was composed of 50 boats, under 11 metres long, each of them operated by a crew of one or two. Though various species of shellfish are harvested in the Bay, the bulk of catches nowadays relies on two species: common scallop (*Pecten maximus*) and warty venus (*Venus verrucosa*). An estimated 273 tonnes of shellfish were landed in 2005–2006[6] and landings from the Bay of Brest represent approximately 1 percent of total French common scallop landings (Anon., 2006). The relative share of the Bay of Brest is more significant in the case of warty venus for which estimated landings amounted to 218 tonnes in 2005–2006 and represented approximately 20 percent of total French landings of this species (Ibid.).

Compared to the situation prevailing half a century ago, the present importance of the fishery is quite limited: in the beginning of the 1950s, the Bay of Brest was one

[5] The population of the urban area of Brest, the second most populated city in Brittany, was 303 484 persons in 1999 and the average population density of municipalities surrounding the bay is close to 400 persons per km² (Anon., 2003).

[6] Unless otherwise stated, data used in this paper were provided by the Local Committee of Fisheries of North-Finistère.

FIGURE 3
Scallop sea-ranching in the Bay of Brest: seeding strategy



Source: local fisheries committee.

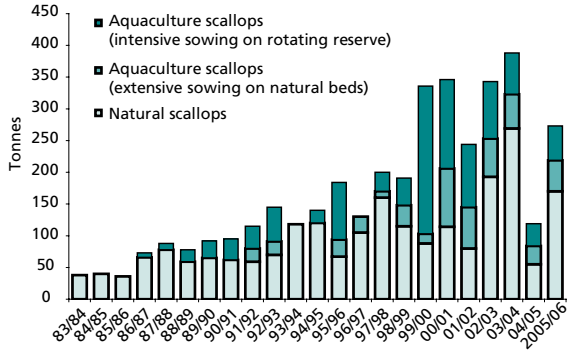
of the major common scallop fisheries in Europe with landings between 1 500 and 2 500 tonnes a year (Figure 2). However, the unusually cold temperature during the winter of 1962–1963 dramatically increased the mortality of juveniles and this climate accident accelerated the decline of a fishery, which was also exposed to a rapid increase in anthropic pressure, related to the motorization of the fleet after World War II (Piboubes, 1973; Boucher and Fifas, 1995). Only 362 tonnes of scallops were landed in 1963–64 and the downward trend continued during the following two decades. In the 1980s, common scallop landings from the Bay of Brest were less than 100 tonnes a year and a minimum of 25 tonnes was reached in 1983–84.

2.2 The scallop restocking/sea-ranching programme

A restocking programme, operated with scientific support from the marine research institute IFREMER, was officially launched in 1983. This programme relies on the activity of an aquaculture unit, including a hatchery-nursery,[7] and a farm growing scallop juveniles in cages at sea. Its original philosophy was to restore the biomass of potential spawners at a level high enough to restart the natural dynamics of the stock. However, the relation between spawning stock biomass and recruitment proved "extremely loose" in the case of *P. maximus* (Boucher and Dao, 1989) due to the fact that yearly recruitment of this species mainly depends on fluctuating water temperature (Fifas *et al.*, 1990). This empirical evidence led to a reorientation of the programme towards a strategy of sea-ranching: scallop juveniles produced by the aquaculture unit are placed in the Bay when they reach the size of 3 cm, so that fishers may harvest survivors two or three years later, once they have reached the minimum landing size of 10.5 cm. Two different sowing methods are used in parallel (Figure 3): extensive sowings on natural

[7] Inspired by the observation of Japanese techniques concerning another variety of pectinids, prior attempts had been made to collect natural post-larvae. The failure of these attempts led to the production of larvae in a hatchery, which was an innovation in the case of *P. maximus* (Fleury *et al.*, 2003).

FIGURE 4
Scallop fishing in the Bay of Brest: yearly landings by type of scallops, 1983–2006



Source: local fisheries committee.

beds and semi-intensive sowings in a rotating zone, closed to fishing during a three-year period (so-called "reserves").[8]

It took the programme a relatively long time to succeed. During the first 12 years, the restocking programme could not provide a significant contribution to the fishery because the yearly output of the aquaculture unit was too limited and fluctuating. As a result, in the middle of the 1990s, the perspective of cancelling the programme, which so far had been funded almost exclusively by public subsidies, was considered imminent (Boncoeur and Guyader, 1995). IFREMER ended its involvement in 1995. However, during the second half of the decade, the production of aquaculture juveniles grew rapidly and, as a result, the number of juveniles sown in the Bay each year rose from an average of 2 million in the first half of the 1990s, to almost 10 million in 2000. The increase in restocking favoured a recovery of harvested quantities (Figure 4): landings of scallops of aquaculture origin (which may be distinguished from naturally-spawned scallops because sowing generates a stress ring on their shell) rose from approximately 30 tonnes in 1990–91 to 230 tonnes ten years later. During the dredging campaign of 2000–2001, scallops originating from aquaculture amounted to more than two-thirds of overall scallop landings. Simultaneously, the financial scheme of the programme changed drastically. This transformation was critical for the programme survival, as public subsidies, which covered nearly 90 percent of its operating costs in 1995, fell to zero in 2000. Alternative funding was provided by a dramatic increase in the yearly cost of licences charged to fishers: from 70 euros a boat in 1994, it soared to 5 200 euros in 2001!

In 2000–2001, a survey was conducted to assess the economic impact of the scallop-restocking/sea-ranching programme for fishers and to investigate their opinions concerning this programme and its financial basis (Boncoeur *et al.*, 2003). According to a simulation developed within the survey, the estimated net contribution of the programme to fishers' annual income was 28 percent in 2000–2001. This contribution is substantial, considering the high cost of the licence fee and the fact that shellfish dredging is only a part-time activity. Unsurprisingly in these conditions, most fishers interviewed during the survey expressed positive opinions on the programme. Less obvious was the acceptance, also revealed by the survey, of the cost-recovery principle by a majority of fishers.

These results were made possible by several technical improvements in the productive process of the aquaculture unit (Fleury *et al.*, 2003). But this alone was insufficient and it was necessary to develop adequate management mechanisms for the new productive process.

3. MANAGEMENT

3.1 The Institutional Framework

French marine fisheries are controlled by the general rules of the EU Common Fisheries Policy (CFP). However, in the case of inshore fisheries, some specific rules apply. The

[8] On natural beds, density of scallops is normally around one individual per 10 to 25 m2, but it can get to one individual per square metre (Quero et al., 1992). In the case of intensive sowings, density rises up to 4-5 individuals per square metre.

most important is the ability for each member-state to exclude foreign boats from fishing in its own territorial waters (12 NM zone)[9]. Another important requirement is due to the fact that inshore fish resources are largely composed of "non-quota species", i.e. species that are not managed on the basis of the European system of TACs and quotas and to which only limited specific EU regulations apply (most shellfish species fall within this category).[10] These legal requirements allow significant latitude to member-states in the management of their inshore fisheries. As a result, a purely inshore fishery such as that of the Bay of Brest is mainly controlled by national rules.

At first sight, the French tradition of political centralism and bureaucratic interventionism fully applies to fisheries management. According to French law, all national decision powers in this field belong to the state, either directly or ultimately[11]. The administrative body in charge of implementing fisheries management decisions is headed by people with military status,[12] reminiscence of Colbert, a minister of the absolute monarch Louis XIV who showed great interest in fishers as a reserve of manpower for the king's navy (the present welfare system for fishers and merchant navy sailors was introduced by Colbert). Another aspect of the Colbertian tradition in French fisheries management (revived during World War II by the Vichy administration) is its corporatist style. The law has instituted a professional organisation of marine fisheries, where by all members of the industry are represented, with a parity of representation for boat-owners and crew members.[13] This organisation is hierarchical, with national, regional and local levels. Each fisher necessarily belongs to a local fisheries committee and participates in the election of the board of this committee. Local committees are represented in the board of the regional fisheries committee where they belong and regional committees are represented in the board of the national fisheries committee. The Bay of Brest fishery falls within the scope of the local fisheries committee of North-Finistère, which belongs to the regional fisheries committee of Brittany.

In the pure Colbertian tradition, the law stipulates that the professional organisation of marine fisheries is under the administrative control of the ministry in charge of the fishing industry.[14] However, it also gives this organisation the opportunity to take part in the fisheries management with a deliberative, though conditional power. According to this legal disposition, the national committee and regional committees are entitled to take resolutions concerning the conservation of fish resources and the administrative authority has the option (but not the obligation) to give these resolutions a compulsory character.[15] In practice, the top-down appearance retained by this formulation is largely a fiction: nowadays, most decisions concerning inshore fisheries management are taken by the professional fisheries organisation and are simply endorsed by state administration. The most dynamic trend concerning inshore fisheries management is the development of a variety of fishing licences by regional fisheries committees. The regional fisheries committee of Brittany has played a pioneering role in this field (Curtil, 2006).

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[9] Except in case of duly recognized "historical rights".

[10] In the case of *P. maximus*, the only specific regulation concerns the minimum landing size, set at 10 cm. Member-states may adopt more restrictive regulations: in the case of the Bay of Brest, the minimal landing size for common scallops is 10.5 cm.

[11] The basic French regulation concerning marine fisheries is a XIXth decree (*Décret du 9 janvier 1852 sur l'exercice de la pêche maritime*), which was modified several times since its first publication. Since the beginning of the CFP in 1983, there have been major modifications to make it consistent with EU rules.

[12] *Administration des Affaires maritimes.*

[13] The present status of this organisation is defined by a 1991 law (*Loi n°91-411 du 2 mai 1991 relative à l'organisation interprofessionnelle des pêches maritimes et des élevages marins et à l'organisation de la conchyliculture*). Shellfish farming (*conchyliculture*), which represents by far the major part of marine aquaculture in France and has its own professional organisation while the rest of marine aquaculture (called *élevages marins* by the law) is administratively tied to the fishing industry.

[14] Article 16 of the above-mentioned 1991 law.

[15] Ibid., Article 5.

Unlike national and regional fisheries committees, local fisheries committees are only given an advisory role by law. However, according to circumstances, these committees may play a much more active role than simply providing advice, especially in the case of purely local fisheries. This consideration fully applies to the Bay of Brest shellfish fishery, which, in practice, is managed by the local fisheries committee of North Finistère, under the formal supervision of the regional fisheries committee shellfish commission and the state administration.

The management of this fishery is based on two specific regulations. First, the fishery was declared a "registered site" in 1964, an administrative decision making it possible to take special conservation measures for local endangered shellfish resources. Second, a limited entry licence system was introduced in 1985. In practice, the two mechanisms have merged and are managed jointly by the local fisheries committee.

3.2 Management innovations

Adapting the management of the fishery to the new productive process generated by the restocking/sea-ranching programme raised two types of institutional difficulties. One concerned space management and the other regulating access of fishers to the resource. Successfully sowing juveniles at sea requires exerting some control over the zones where these operations take place. First, it is necessary to protect beds from disturbance by human activities soon after juveniles have been sown.[16] A second condition, critical in the case of intensive sowings on the rotating reserve, is to make sure there is no premature harvest of the scallops. Fulfilling these conditions is complicated by the fact that fishers, unlike farmers, have no property rights, or exclusive use rights, on the space where they do their scallop restocking. To overcome partly this difficulty, the local fisheries committee first thought of providing a legal status to its rotating reserve by having it classified as a shellfish-farming concession. However, this idea proved unrealistic from an economic point of view because the fees paid to the state for shellfish-farming concessions are established on the basis of oyster or mussel cultivation, which corresponds to much higher densities (and hence revenue per surface unit) than scallop farming.

Another institutional difficulty was related to the regulation of access to the resource. If the French system of licences empowers the industry to control, under formal state supervision, the access to inshore fish resources, it is a well-established tradition, in this country, that fishers should not be charged much more than a symbolic fee for this access, which implies administrative rationing rather than market equilibrium.[17] As a result, the idea that fishing licence fees should bear some relation to the scarcity of fish resources and with the cost of fisheries management is quite unfamiliar to the national political culture. In this context, convincing fishers that they should cover the operating costs of a restocking programme (so far entirely funded by public money) was anything but trivial, even assuming a substantial improvement in the results of the restocking programme.

The local fisheries committee addressed these institutional problems quite pragmatically.

Concerning space management, the committee took advantage of the possibilities offered by the joint system of "registered site" and shellfish licence to delimit the zones open to dredging each year and fishing season. In this way, it was possible to prevent

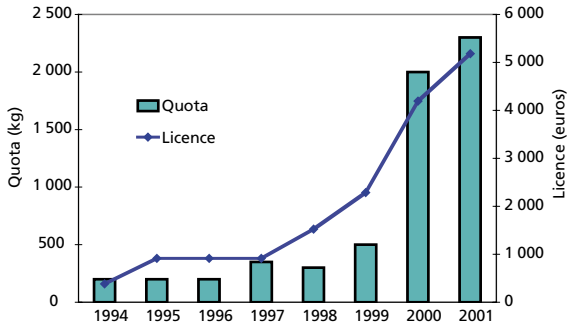
[16] A typical cause of disturbance is the use of towed fishing gears in the area. As trawling is forbidden in the bay, the problem amounts to controlling the time and place of shellfish dredging operations.

[17] Of course, this well-established principle does not imply that access is actually free: using hedonistic prices methodology, Guyader *et al.* (2006) demonstrated that, on the average, 50 percent of the price paid for a second-hand fishing boat in France during the 1990s represented an implicit cost of access to the resource (notwithstanding the fact that, according to French law, specific licences are not supposed to be sold with boats).

natural scallop beds from being dredged too early after the sowing of juveniles and also to ban scallop fishing for the number of years considered appropriate (usually three) in the zones of intensive restocking. The so-called "reserve" has no other legal recognition.

As regards cost-recovery, it was necessary to convince fishers of accepting a dramatic increase in the yearly shellfish licence fee. To this end, the local fisheries committee adopted a strategy based on the harvest of the reserve. In contrast to the harvesting of natural scallop beds, which are managed on an input-control basis (limitation of fishing time and fishing power), harvesting the rotating reserve is managed by means of individual catch quotas. The size of these quotas is the same for all licensed boats. These are established each year by the committee according to the abundance of harvestable scallops in the reserve. The improved technical results of the aquaculture unit made it possible to raise the quota from 200 kg a boat in 1994 to 2 300 kg a boat in 2001. During that period, the policy adopted by the committee was to increase the annual quota and licence fee proportionally (Figure 5), so that the fee charged to fishers could be kept below the revenue provided to them by the quota. As a result of this "quota strategy", fishers concluded that the quota, which could be harvested with little effort due to the high density of scallops in the reserve, "paid the price of the licence" and, moreover, left them a bonus. Naturally, the success of this policy relies on the productivity of the reserve, which depends on the quantity of juvenile scallops that were sown and of their survival rate. It is also conditioned by the level of landing prices.

FIGURE 5
Scallop fishing in the Bay of Brest: shift towards cost recovery and 'quota strategy', 1994–2001



Source: local fisheries committee.

4. DISCUSSION

4.1 Recent history

The technical and financial achievements observed during the second half of the 1990s were critical for the survival of the scallop-restocking programme of the Bay of Brest. Moreover, during this period, Bay fishers demonstrated their ability to transform a scientific experiment funded by public money into an economically sustainable activity based on cost-recovery and to manage it. To this end, they created a new cooperative in close relation with the local fisheries committee. The cooperative sells the juveniles to the committee at a price covering production costs. The committee restocks the juveniles, manages the fishery and collects the cash necessary for buying the juveniles through the licence fees. This sea-ranching model is quite innovative in France and managers of other scallop fisheries have expressed their interest in this innovation buying limited quantities of juveniles from the Bay of Brest cooperative to test the feasibility of the model in their own fishery.

However, the recent evolution of the Bay of Brest fishery shows that this model is not yet stabilized. It faces several important risks that might jeopardize its economic sustainability. Some of these risks are due to exogenous threats (3.1) and others are related to endogenous deficiencies of the management system of the fishery (3.2).

4.2 Exogenous threats

First, the fishery is exposed to significant environmental risks. One of them is due to the increasing frequency of various toxic microalgal blooms in the Bay, probably related to the influx of nutriments generated by agriculture and other human activities around the Bay. Some of these blooms (*Gymnodinium cf. nagasakiense*) cause a high

mortality of scallop larvae and post-larvae; others make adult scallops temporarily unfit for human consumption. The 2004 *Pseudo-Nitschia* diatom bloom cut the 2004–2005 by four months and there was a resulting drop in quantities harvested from natural beds of 72 percent compared to the average of the three previous campaigns. Another environmental risk is due to the proliferation of an exotic shellfish (*Crepidula fornicata*), accidentally imported in the Bay some decades ago that acts as a competitor with common scallop for space. The proliferation of *Crepidula fornicata* is a challenge to sea ranching in the Bay, because it reduces the number and surface of areas that are fit for restocking of scallops juveniles. The local fisheries committee has elaborated a containment programme (Frésard and Boncoeur, 2006), but the problem raised by the disposal of significant quantities of valueless harvested invasive shellfish is still unsolved. Moreover, some scientists have expressed concern about the environmental risks of this harvest as the invasive species are suspected of acting to limit the occurrence of toxic microalgal blooms (Chauvaud *et al.*, 2003).

Besides environmental risks, the sea-ranching programme faces an economic risk related to price volatility. The landing price of Bay of Brest scallops is mainly influenced by landings from the the Bay of St-Brieuc and the Bay of Seine which are the two major French scallop fisheries (Boncoeur, Divard and Guyader, 1977). Significant fluctuations of landings are observed in these large fisheries, generating considerable price changes with direct repercussions on the Bay of Brest scallop fishery. For instance, in 2004–2005, the average landing price of the Bay of Brest scallop dropped by 20 percent compared to the average of the three previous years and this phenomenon added its negative consequences to fishers' incomes in addition to those of the *Pseudo-Nitschia* bloom (see above). In order to limit these consequences, the local fisheries committee obtained a derogation from the state concerning the scallop fishery closing date[18] and authorized fishers to harvest an extra 30 tonnes of scallops from the reserve. They decided to reduce exceptionally the licence fee by 45 percent for year 2005[19]. However, this was not enough for preventing a decrease in the number of licensed boats, which dropped from 70 in 2004 to only 55 in 2005, endangering the financial equilibrium of the sea-ranching programme.[20]

4.3 Endogenous deficiencies

The impact of environmental and economic exogenous factors might be worsened by some endogenous deficiencies concerning the management system of the fishery and its sea-ranching programme. The financial scheme of the programme offers a good entry point for the analysis of this question. Though it had the great merit of creating the conditions for cost-recovery in a limited number of years, the scheme has two major drawbacks: (a) it generates distortions among fishers and (b), it does not favour their long-term commitment to the programme. Distortions arise from the fact that the annual licence fee is uniform and therefore does not account for the differences between individual harvesting capacities.[21] Advocates of the present system underline that the counterpart of a uniform licence fee is a uniform harvesting quota, but this argument is not fully convincing since the licence covers the various shellfish resources of the Bay and not only the scallop stock of the reserve. Estimations of the resulting distortion showed a significant impact on the income of fishers (Alban *et al.*, 2004). The second major drawback of the present system is the lack of long-term commitment

[18] A national regulation prohibits common scallop harvesting between 15 May and 30 September.

[19] Although each scalloping campaign takes place over two years, licences are established on January-to-December basis.

[20] Despite a recovery of landings in 2005-2006, the number of licenses has continued to shrink and only 49 boats took a license in 2007.

[21] As proven by individual landings declarations, these differences are far from neutralized by the limitations imposed by the licence system concerning boat length and characteristics of dredges.

to the programme and is due to the fact that fishing licences and associated fees are annual. In a fishery where these fees are high, this feature is likely to induce free-riding behaviours, as fishers may be tempted to take a licence only if the next campaign is expected to be rewarding enough. The development of such short-term opportunistic behaviours would directly threaten the sustainability of a programme depending on long-term commitment of stakeholders.

These two deficiencies may certainly be overcome, but significant steps in this direction would probably induce major transformations in the present management system. For instance, putting an end to the distortions between fishers caused by uniform licence fees would require each one to be charged in proportion to the benefits he gets from the fishery. This might be achieved by taxing landings, or by generalizing the individual quota system that, so far, has been used only for the harvesting of the reserve. Both solutions require a good transparency of landings, a condition which was not considered as fully satisfied by fishers themselves at the beginning of the present decade (Boncoeur *et al.*, 2003). Despite their efforts to increase transparency, the local fishers organisation estimates that, on the average, fishers fail to record 20 percent of their catches from natural beds.

In a similar way, stimulating long-term commitment of fishers could be achieved by creating a multi-annual licence, or a system of permanent quotas defined as percentages of a TAC that would be revised each year, according to harvestable stock abundance. But in both cases, fishers would probably not accept the long-term financial commitments if it was not associated with a certain amount of liquidity, which calls for explicit transferability of fishing rights.

5. CONCLUSION

Though the second attempt of Bay of Brest fishers to sustain their activity by combining it with aquaculture shows greater longevity than the earlier one, the fishery is far from having recovered the level of abundance and activity it had reached half a century ago: since 1999, annual scallop landings have amounted to 312 tonnes on the average[22], which is scarcely one fifth of the average level observed during the 1950s (the ratio is only 12 percent for the number of jobs). Nevertheless, compared to the situation prevailing in the 1980s, the improvement is significant. With due provision for fluctuations in natural recruitment, it is clear that the restocking/sea-ranching programme has plaid a major role in this improvement: scallops originating from aquaculture have amounted to 55 percent of total Bay scallop landings over the period 1999–2004. Moreover, this technical achievement was combined with a spectacular evolution towards economic sustainability: the programme moved in five years from complete financial assistance to a situation of cost-recovery. The fact that the level of the annual licence fee paid by the Bay of Brest fishers has no equivalent in the whole French fishing industry underlines the unusual character of this transformation.

Probably the most striking feature of the programme management is its adaptability. This feature first showed itself on a technical ground: initially aimed at rebuilding the biomass of the spawning stock, the programme was redirected towards sea-ranching when it became clear that the spawning stock biomass had little influence, if any, on annual recruitment. The same pragmatism may be observed in the field of institutions and finance. Facing an original configuration and an inappropriate institutional environment, the local fisheries committee showed a real sense of creativity. Taking advantage of the licence system, it demonstrated a capacity to manage space so as to make restocking operations viable and to durably operate a reserve in the absence of

[22] Dredging campaigns from 1999-2000 to 2005-2006, excluding 2004-2005 campaign where the fishery was closed for four months due to a toxic microalgal bloom. Including this campaign would bring the average down to 286 tonnes.

any legal base. The programme was initially conceived as a simple technical experiment, but the reserve then came to play a highly political role when the committee had to convince its members to pay for the cost of the programme.

Notwithstanding the undeniable merits of this institutional creativity, outcomes are fragile. As regards space management, the increase in environmental risks underlines the fact that the sustainability of the fishery and its sea-ranching programme cannot rely only on the control of fishing space: without an integrated management of the Bay area seriously addressing the problem of effluents coming from inland activities, sea-ranching might well be the next victim of the recurrent toxic micro-algae blooms.[23] The problem is not merely institutional: not only is the local fisheries committee deprived of any legal capacity to regulate inland activities, but the economic (and political) weight of these activities is far more important than that of the small-scale shellfish fishery of the Bay.[24] Considering this difficulty, forming an alliance with environmentalist groups might be a rewarding strategy for fishers, but it would require overcoming some cultural barriers.

The existence of serious exogenous threats is undeniable and we argue that the fragility of the fishery and its sea-ranching programme also have endogenous threats, namely deficiencies of the management system. Reforms that could improve the situation may be classified in two categories: (a) actions that are clearly within the scope of the local fishers organisation (which does not imply that they could be easily achieved) and (b), actions probably calling for changes at a higher level. Increasing accurate reporting of landings belongs to the first category. This reform is obviously high on the agenda: it requires an accurate and reliable monitoring of the fishery and is a prerequisite for a financial scheme generating fewer distortions and more incentives for a longer term commitment than exists at present. On the other hand, making fishing rights multi-annual and transferable would contradict present French law.[25] Assuming the local fisheries committee had this type of reform on its agenda, it is not sure that the creativity it showed in the past would be enough to overcome this difficulty.

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[23] An EU directive requires that inshore saltwater, as well as continental freshwater, should have a "good ecological condition" by 2015. This requirement is likely to provide fishers with a strong legal base for defending their cause, though what is exactly meant by "good ecological condition" of water is still a matter of debate. Moreover, 2015 is still in the distant future, compared to the immediate timing of some imminent environmental threats hanging over the fishery.

[24] Farming and agro-industries provided 11,000 jobs in the Brest employment area in 2001 (Anon., 2003).

[25] Loi n°97-1051 du 18 novembre 1997 d'orientation sur la pêche maritime et les cultures marines, art. 4.

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